Two Independent Samples Checkpoint

Question (1)

A teacher is experimenting with a new computer-based instruction and conducts a study to test its effectiveness. In which situation could the teacher use the two-sample t-test for comparing two population means?

A: The teacher gives each student in the class a pretest. Then she teaches a lesson using a computer program. Afterwards, she gives each student a post-test. The teacher wants to compare test scores for each student to see whether the data will show an improvement.

B: The teacher randomly divides the class into two groups. One of the groups receives computer-based instruction and the other group receives traditional instruction without computers. After instruction, each student takes a test and the teacher wants to compare the test scores of the two groups.

C: The teacher uses a combination of traditional methods and computer-based instruction. She asks students which they liked better. She wants to determine if the majority prefer the computer-based instruction.

Feedback

A : 0

✗ Incorrect. Since the same group of students was measured twice (once before and then after instruction), this is a case of matched pairs design. The correct answer is B.

B : 10

✓ Good Job! Since students were *randomized* to two different groups the data obtained from this study should be analyzed using the two (independent) samples t test.

C : 0

✗ Incorrect: The teacher collects data on the variable: "liked computer-based instruction better" (yes/no). With this data, the teacher could test a hypothesis about a proportion. The correct answer is B.

Question (2)

College Students and Drinking Habits: A public health official is studying differences in drinking habits among students at two different universities. They collect a random sample of students independently from each of the two universities and ask each student how many alcoholic drinks they consumed in the previous week.

Sample Statistics

	Size (n)	Mean ($\bar{x}$)	SD (s)
Sample 1	40	6.9	2.3
Sample 2	49	5.7	1.9

The official conducts a two-sample t-test to determine whether these data provide significant evidence that students at University 1 drink more than students at University 2. The test statistic is t = 2.64 with a P-value 0.005. Which of the following is an appropriate conclusion?

A: The samples provide significant evidence that students at University 1 drink more than students at University 2.
B: The samples do not provide statistically significant evidence.
C: We can not use the t-test in this case because the variables (number of drinks) are likely skewed to the right at each university.

Feedback

A : 10

✔ Good job! A P-value this small indicates statistically significant results.

B : 0

✘ Incorrect: A P-value this small indicates statistically significant results. The correct answer is A.

C : 0

✘ Not quite right: Although the two variables are likely skewed to the right, we can proceed with a two-sample t-test because we have large enough samples. The correct answer is A.

Question (3)

In a study of the impact of smoking on birth weight, researchers analyze birth weights (in grams) for babies born to 189 women who gave birth in 1989 at a hospital in Massachusetts. In the group, 74 were categorized as "smokers" and 115 as "non-smokers." The difference in mean birth weights (non-smokers minus smokers) is 281.7 grams with a margin of error of 205.2 grams with 95% confidence.

Which gives the best interpretation of what we can conclude about the impact of smoking on birth weight?

A: We are 95% confident that on average, smoking causes lower birth weights of between 76.5 grams to 486.9 grams.

B: There is a 95% chance that if a woman smokes during pregnancy her baby will weigh between 76.5 grams to 486.9 grams less than if she did not smoke.

C: Smoking is associated with lower birth weights. When smokers are compared to non-smokers, we are 95% confident that the mean weight of babies of non-smokers is between 76.5 grams to 486.9 grams more than the mean weight of babies of smokers.

D: With such a large margin of error, this study does not suggest that there is a difference in mean birth weights when we compare smokers to non-smokers.

Feedback

A : 0

✗ Not quite right: this study is an observational study. We cannot make cause-and-effect statements from an observational study. We could say "We are 95% confident that smoking is associated with birth weights that are between 76.5 and 486.9 grams lower than non-smokers." The correct answer is C.

B : 0

✗ Incorrect: The 95% confidence is not a statement about an individual woman, but rather a statement about the difference between the mean weight of babies of ***all*** non-smoking women and the mean weight of babies of ***all*** smoking women. The correct answer is C.

C : 10

✓ Good job! This study is an observational study, so the use of the phrase "is associated with" is appropriate. The use of the phrase "95% confident" with a specific confidence interval is also appropriate.

D : 0

✗ Incorrect: The interval does not contain zero, so the interval does suggest that there is a difference in mean birth weights for the two groups. The correct answer is C.

Question (4)

Do oddsmakers believe that teams who play at home will have home field advantage? Specifically, do oddsmakers give higher point spreads when the favored team plays home games as compared to when the favored team plays away games? Two

samples were randomly selected from three complete National Football League seasons (1989, 1990, and 1991). The first sample consisted of 50 games, where the favored team played in a home game, while the second sample consisted of 50 games, where the favored team played in an away game. The oddsmakers point spreads (which are the number of points by which the favored team is predicted to beat the weaker team) were then collected.

If μ_1 and μ_2 represent the mean point spread for home games and away games, respectively, which of the following is the appropriate pair of hypotheses in this case?

A:

H_o: $\mu_1 - \mu_2 = 0$

H_a: $\mu_1 - \mu_2 < 0$

B:

H_0: $\mu_1 = \mu_2$

H_a: $\mu_1 < \mu_2$

C:

H_0: $\mu_1 - \mu_2 > 0$

H_a: $\mu_1 - \mu_2 = 0$

D:

H_0: $\mu_1 = \mu_2$

H_a: $\mu_1 > \mu_2$

E:

None of the above

Feedback

A : 0

✗ This is not quite right. Remember that you want to see if the mean point spread for the home games (represented by μ_1) is ***higher*** compared to the away games. Consider the

remaining options; the correct answer is D.

B : 0

This is not quite right. Remember that you want to see if the mean point spread for the home games (represented by μ_1) is ***higher*** compared to the away games. Consider the remaining options; the correct answer is D.

C : 0

That's not quite right. Remember, the null hypothesis is ***always*** no differences. Consider the remaining options; the correct answer is D.

D : 10

Correct! Since you want to see if the mean point spread is ***higher*** for the home games as compared to the away games, the alternative hypothesis is: H_a: $\mu_1 > \mu_2$.

E : 0

This is not quite right. Remember that you want to see if the mean point spread for the home games (represented by μ_1) is ***higher*** compared to the away games. Consider the remaining options; the correct answer is D.

Question (5)

Analyses were run. The following is the (edited) output for the test:

Hypothesis test results:

μ_1 : Favored Team - Home Game

μ_2 : Favored Team - Away Game

Difference	Sample Mean	Std. Err.	DF	T-Stat	
$\mu_1 - \mu_2$	0.11	0.67168534	94.155815	0.16376716	

From the output we learn that:

A: the data provide sufficient evidence reject the H_0; thus, we cannot conclude that the mean point spread of home games is higher than that of away games.

B: the data do not provide sufficient evidence reject the H_0; thus, we can conclude that the mean point spread for home games is higher than that of away games.

C: the data do not provide sufficient evidence to reject H_0; thus, we cannot conclude that the mean point spread of home games is higher than that of away games.

D: the data provide sufficient evidence to reject H_0; thus, we can conclude that the mean point spread for home games is higher than that of away games.

Feedback

A : 0

✗ This is not quite right. Notice that the P-value is greater than .05. Consider the remaining options; the correct answer is C.

B : 0

✗ This is not quite right. While it is correct that the P-value is greater than .05 and, therefore, the null hypothesis is not rejected, your conclusion is wrong. The correct answer is C.

C : 10

✔ Correct! Since the P-value is greater than .05, we fail to reject the null hypothesis and, therefore, cannot conclude that the mean point spread of home games is higher than that of away games.

D : 0

✘ This is not quite right. Notice that the P-value is greater than .05. Consider the remaining options; the correct answer is C.